

What Is Claimed Is:

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1. A method for generating turbulence of an air-fuel mixture in a combustion chamber of a multi-valve engine, said engine having at least first and second intake valve members each independently
5 activated by an actuator member, with the activation of the actuator member being controlled by an engine controller unit, the method comprising the steps of:
determining an operating condition of the engine;
10 separately operating the intake valve members to generate an air-fuel turbulence in the engine combustion chamber corresponding at least in part to the operating condition;
wherein the optimum air-fuel turbulence is
15 created for the operating condition to maximize fuel efficiency and minimize undesirable emissions.
2. The method for generating turbulence as set forth in claim 1 wherein a look-up table is utilized to operate the actuator members and
20 accompanying intake valve members depending on engine load and speed.
3. The method for generating turbulence as set forth in claim 1 wherein said intake valve members are operated in accordance with a look-up table which
25 has been established for the engine.
4. The method for generating turbulence as set forth in claim 1 wherein said first intake valve member is a tumble-type intake valve member.

5. The method for generating turbulence as set forth in claim 1 wherein said second intake valve member is a conventional intake valve member.

6. The method for generating turbulence as
5 set forth in claim 1 wherein said first intake valve member is a tumble-type intake valve member and said second intake valve member is a conventional intake valve member.

7. The method for generating turbulence as
10 set forth in claim 6 wherein in light-load conditions of the engine, said first valve member is disabled and only said second valve is operated.

8. The method for generating turbulence as
15 set forth in claim 6 wherein in light-load conditions of the engines, said first valve member is disabled and a swirl air flow motion is generated in the combustion chamber.

9. The method for generating turbulence as
20 set forth in claim 6 wherein in a first mid-load condition, an inclined swirl air flow motion is generated in the combustion chamber.

10. The method for generating turbulence as
25 set forth in claim 9 wherein said inclined swirl air flow is generated by first opening said second valve for a first portion of the intake process and then concurrently opening said first valve for a second portion of the intake process.

11. The method for generating turbulence as
30 set forth in claim 9 wherein said second valve is disabled.

12. The method for generating turbulence as set forth in claim 1 wherein in a second mid-load condition of the engine, a tumble air flow motion is generated in the combustion chamber.

5 13. The method for generating turbulence as set forth in claim 12 wherein said tumble air flow motion is generated by timing the openings of both of said first and second valve members during the intake process.

10 14. The method for generating turbulence as set forth in claim 1 wherein in a full-load condition of the engine, both of said first and second valve members are operated at conventional timings for the engine.

15 sub a2 15. A process for optimizing the air-flow motion in the cylinder combustion chambers of a multi-valve engine, each of said cylinders having a first intake valve and a second intake valve, both of said first and second intake valves being individually and
20 independently operated, and the engine having an electronic controller for operating said first and second intake valves, said process comprising the steps of:

25 establishing a plurality of operating conditions for the engine based on engine load and speed;

preparing a look-up table based on said plurality of operating conditions;

30 operating said first and second intake valves depending on the look-up table relative to a first engine load and speed; and

generating an air flow motion in the cylinder combustion chamber corresponding to one of said plurality of operating conditions.

16. A system for generating turbulence of an
5 air-fuel mixture in a combustion chamber of a multi-valve engine, said engine having at least first and second intake valve members, and a controller unit, said system comprising:

10 means for determining an operating condition of the engine;

means for separately operating said first and second intake valve members in order to generate a desired air-fuel turbulence in the engine combustion chamber corresponding at least in part to said
15 operating condition;

wherein an optimum air fuel turbulence is created for said operating condition to maximize fuel efficiency and minimize undesirable emissions.

17. The system as set forth in claim 16
20 wherein said means for determining an operating condition comprises a look-up table.

18. The system as set forth in claim 16 wherein said first intake valve member is a tumble-type intake valve member and said second intake valve member
25 is a conventional intake valve member.

19. The system as set forth in claim 16 wherein a plurality of operating conditions are established for the engine based on engine load and engine speed and said first and second intake valve
30 members are separately operated in accordance with one of said operating conditions in order to generate a

corresponding air flow motion in the combustion chamber.

20. The system as set forth in claim 17 wherein said look-up table contains a plurality of operating conditions for the engine based on engine load and engine speed, and said first and second intake valve members are separately operated in accordance with one of said operating conditions in order to generate a corresponding air flow motion in the combustion chamber.